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FARM & HOME SCIENCE



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An Analysis of the Frozen Fruit Industry in Utah

Anticipated Rapid Post-War Developments in This Industry Offer Many Possibilities

By D. G. SORBER

Western Regional Research Laboratory

COMMERCIAL freezing preservation of berries was started by Mr. H. A. Baker in the Pacific Northwest in 1909 or 1910. The process known then as cold pack, which represents the beginning of the frozen-pack industry, consisted of packing layers of strawberries or raspberries and sugar in 50-gallon barrels. A block of ice was placed in the center of the mass as the barrel was being filled. The barrels of berries were then frozen and stored in a cold-storage warehouse at about 15° F. The principal, if not the exclusive, use of frozen berries in those early years was for the manufacture of jams and preserves.

At about the same time or perhaps a little later the freezing of sour-pitted cherries for pie bakers was begun in Michigan.

Recent Expansion of Frozen Food Industry

Frozen fruit production in the United States underwent a rather fluctuating growth from its beginning up to 1937. The total production was a little over 12½ million pounds in 1925, which was increased to nearly 85 million pounds in 1930 and then dropped back, with considerable variation from year to year, to slightly more than 70 million in 1936. In 1937 the total production jumped to 111 million pounds (55,500 tons). Since then there has been a large increase each year until in 1942 the figure reached nearly 222 million pounds (111,000 tons). This was increased to 228.5 million pounds in 1943.

One reason for the rapid increase in recent years is the expanding number of uses that are being made

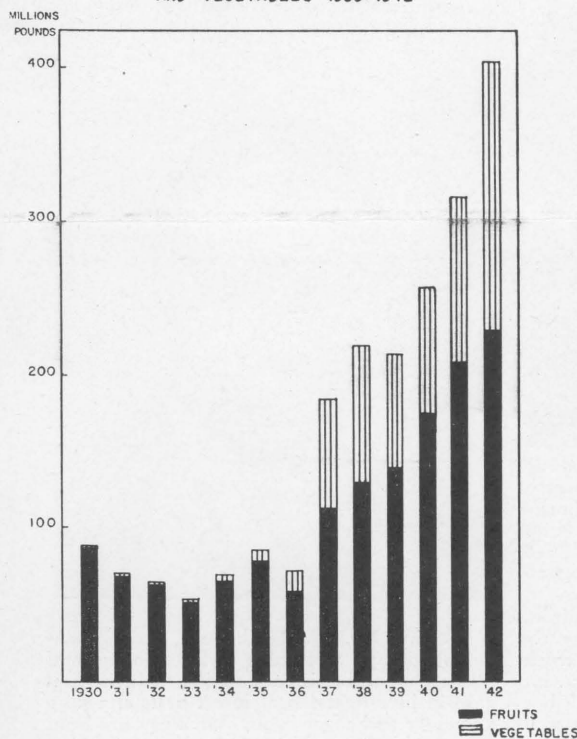
of frozen fruit. Besides the consumer-sized packages containing fruit packed in sugar or syrup for direct consumption, there are whole and cut fruits for use in jams, preserves, and baked goods; fruit purees for use in ice cream, sherbets, beverages, jams, and baby foods; and also frozen fruit juices. Other reasons for the expansion are that an increasing number of kinds of fruit are being frozen, and in increasing quantities.

A report by the Bureau of Agricultural Economics on the Production and Consumption of Fruits from 1909 to

1940 issued in July of last year says, "The apparent per capita consumption of frozen fruits in the United States has not yet attained the importance that it probably will reach in the post-war years. The average per capita consumption before 1938 was under one pound. From 1938 through 1940, it averaged 1.1 pounds."

A report by F. L. Thomsen and Richard Gabel of the Bureau of Agricultural Economics, issued in August, 1943, gives the per capita consumption of fruits and fruit juices for the years 1935 to 1943. The per capita consumption of frozen fruits increased from 0.5 pounds in 1935 to 1.5 pounds in 1943. During the same period the per capita consumption of fresh fruit varied from a peak of 142.8 pounds in 1939 to the low of 109.8 pounds in 1939 to the low of 109.8 pounds estimated for 1943, while consumption of canned fruit rose from 23 pounds per capita in 1935 to a peak of 44.1 pounds in 1941 and then dropped back to a preliminary estimate of 21.1 pounds in 1943. The variation in the consumption of fresh fruit from year to year, it will be noted from these figures, was 22 times as much as the total frozen fruit consumed at the present time, while the variation in the canned fruit consumed during this period was 15 times as great as the maximum consumption of frozen fruits. It would seem, then, that there is an opportunity for considerable expansion in the frozen fruit industry in the United States without seriously affecting the volume of fruit marketed in other ways.

U.S. PRODUCTION OF FROZEN FRUITS
AND VEGETABLES 1930-1942



(Continued on page 8)

The Department of Entomology

THE Entomology Department of the Utah Station came into being near the turn of the present century when Dr. E. D. Ball was appointed as the first full-time entomologist in 1902. One of the first insect problems to be investigated was that of codling moth (apple worm) control. Another outstanding contribution to agriculture, as well as to economic entomology, during this time was the discovery by the Utah Station that the virus which causes "curly top" of sugar beets is transmitted by an insect, the beet leafhopper.

Following Dr. Ball, Dr. E. G. Titus became head of the department in 1907. He began an investigation of the alfalfa weevil problem, determining the distribution of this new pest, working out its life history and methods for its control.

In 1917, Dr. W. W. Henderson became head of the department and remained in this position until 1920. He was succeeded by Dr. I. M. Hawley in 1921 who remained until 1926 when Dr. Henderson returned to head the department again. The chief entomological work of Dr. Henderson has been scientific investigations of the Orthoptera (grasshoppers, crickets and their allies) of Utah. Because of the wide range of crops upon which they feed, this group of insects includes some of

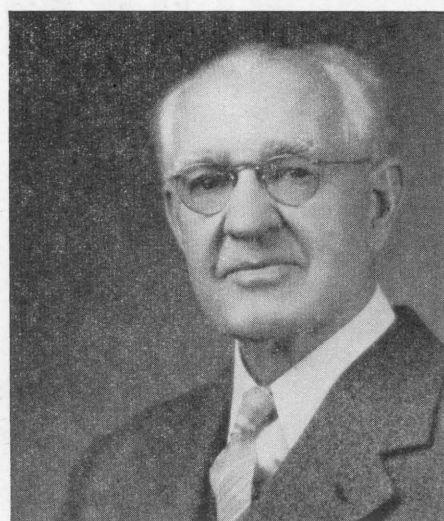
the most destructive pests such as grasshoppers and Mormon crickets.

In addition to this work, members of the Entomology Department at the present time are investigating a number of insect problems of serious economic importance to Utah agriculture. Since the 1920's alfalfa seed production has been falling off in the state. Station entomologists have found that the chalcis fly and lygus and superb plant bugs inflict serious injury to alfalfa. No satisfactory methods of control of these last two bugs have yet been worked out.

Other studies have been made on the pale western cutworm, its life history and control; the life and habits of the potato psyllid and methods of control; the oblique banded leafroller, a dewberry fruit pest; and the strawberry root weevil.

Intensive studies of the beet leafhopper and host plant conditions in desert breeding areas have been underway for a number of years in cooperation with the U. S. Bureau of Entomology and Plant Quarantine. At present these investigations are concerned largely with reduction of curly top disease transmission by the beet leafhopper to tomatoes and susceptible truck crops other than beets.

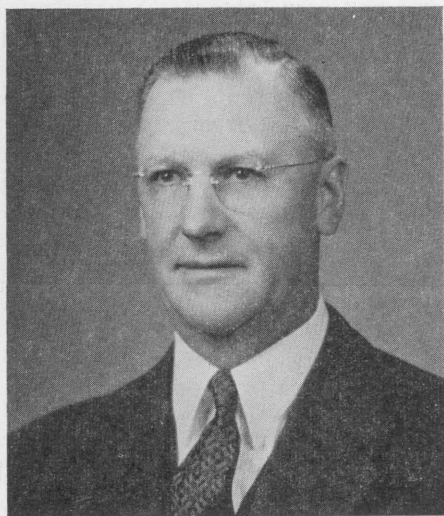
Studies in cooperation with the Veterinary Science Department on blood sucking insects as carriers of brain fever of horses showed two local species of mosquitoes capable of transmitting the virus of brain fever.



Dr. W. W. Henderson heads the Department of Zoology and Entomology. He is not only known as one of the outstanding teachers of the state, but also as an authority on the Orthoptera. Dr. Henderson has been head of the department here since 1926

Control programs for the pea aphid which threatened the canning pea crop have been developed through Station investigations. Now power dusters treat large areas to control this pest and thus insure safe production of the pea crop in northern Utah.

Other investigations being currently made by the Entomology Department include the relationship of bees to tripping and pollinating of alfalfa flowers; the life histories and control of the peach twig borer and pentatomid bugs; the causes of the serious bee losses occurring in Utah; life history and control of the tomato fruitworm, and of thrips which enter the tomato fruits through the blossom end, often becoming sealed inside the fruit where they grow and reproduce.

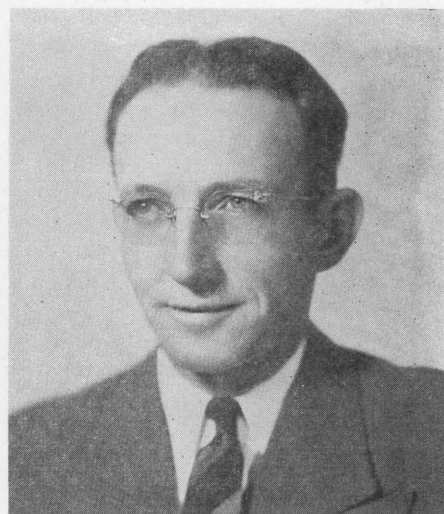


(Above) Professor C. J. Sorenson, research associate professor, is the Station authority on insect pests attacking forage crops, fruit trees, and stored grains. He has published a number of articles on insects affecting alfalfa seed production

(Above, right) Dr. George F. Knowlton, research associate professor, handles the research on control of insects infesting truck crops, livestock and small fruits. At present he has charge of the investigations of bee losses. He has published widely and is well known as an authority on aphids



(Right) Mr. Walter E. Peay, assistant entomologist, U. S. Bureau of Entomology and Plant Quarantine is cooperating with the Station in investigations of insect pests attacking tomatoes and sugar beets. Mr. Peay has been stationed in Logan since 1941



RED RASPBERRY VARIETIES FOR FREEZING, LOCAL MARKET, AND HOME USE

By FRANCIS M. COE

THE RED RASPBERRY is the favorite bush fruit in Utah home gardens, and has been cultivated since pioneer days in the intermountain region. The agreeably refreshing tart-sweet flavor, juicy texture, and attractive form and color of this fruit have made it a universal favorite for home use and market, and resulted in higher prices than those paid for most other fruits and berries. Introduction of the quick-freezing process of preservation which preserves the fresh fruit flavor, form, and color better than canning and so makes possible delicious raspberries all year round; rapid expansion of the quick-freeze locker industry; the rise of ice cream in the diet of the American people and the increasing popularity of raspberry as an ice cream flavor; and the development of larger, more productive raspberry varieties have caused the demand for this fruit greatly to exceed the supply, and opened up greater opportunities for its profitable culture in the irrigated valleys of the west.

According to the 1939 census, 1,068 farms in Utah reported growing red raspberries with a total of 561 acres, producing 1,181,074 pounds of berries, as compared to 155 farms growing 50 acres and harvesting 76,204 pounds of blackcap raspberries. Red raspberries make up nearly 90 percent of the raspberries in Utah. Utah County has 67 percent of the state's red raspberry acreage, 379 acres, with a yield of 777,423 pounds reported in 1939. Other important counties in red raspberry production, with their acreage in 1939 are as follows: Cache, 34; Box Elder, 32; Salt Lake, 27; Weber, 26; Davis, 22.

Since 1927, the Utah Agricultural Experiment Station has tested raspberry varieties to determine their adaptability and value, and to find new sorts more profitable for growing under Utah conditions. In recent years special emphasis has been placed on varieties for commercial freezing as seedless raspberry puree for ice cream making. In all, over 75 different varieties of raspberries have been tested, and the majority discarded. In addition, over a thousand hand-crossed seedlings are being fruited and studied to obtain superior new varieties of this fruit.

Qualities essential in a good commercial raspberry are: retention of form,

color, and flavor in freezing, sufficient tartness to make a good jam and bring out the flavor in ice cream; large size, ease of picking, bright red color; superior vigor and productiveness; resistance to chlorosis; a high degree of hardiness; and a good plant maker.

In 1928, Cuthbert and Marlboro were the leading varieties of red raspberries in Utah. Cuthbert, because of its high quality and deep red color, has been the standard berry of the Northwest for market and freezing. Unfortunately it frequently winter-kills in Utah, and its lack of size makes it more difficult and expensive to harvest than several larger varieties. Yields also are considerably under several of its competitors. The red raspberry variety problem, then, has been to find varieties of equal quality which are larger, hardier, and more productive than Cuthbert.

About 16 years ago the planting of Latham was urged. This variety, which originated in Minnesota, is hardier, more productive and of larger size than Cuthbert. It has largely replaced the Marlboro, which was discarded because of its light red color which faded in canning and freezing, and its small size of fruit. Latham has become the principal variety of raspberry grown, and is probably still the best variety for planting where a high degree of hardiness is required. Its rather light red color, large drupelets, lack of tartness, and tendency to crumble when not fully ripe, are faults of the variety. For fresh use and home freezing, Latham is quite acceptable, and is also accepted by commercial freezers and markets under present conditions, but it is not liked as well as Cuthbert, or the newer Taylor and Newburgh varieties which will give increasing competition to Latham plantings in the future.

Large size, attractive color and shape of fruit, firmness and ability to stand shipping and hauling, and tart flavor which make it rank high in quality for freezing, ice cream, and jam making, make TAYLOR the most promising of the new varieties for commercial planting. This berry was produced by George L. Slate, well known plant breeder of the New York Agricultural Experiment Station at Geneva, who named it after a former horticulturist of the station. Taylor appears to have one serious fault



"It a pleasure to pick the new Newburgh raspberry, they're so large and hang in clusters," Professor F. M. Coe and Mrs. Bill Johnston, Logan, show the heavily laden bushes of Newburgh in the experimental plots at Logan, July 1943—Photo courtesy Salt Lake Tribune

in Utah, it is but little hardier than Cuthbert, and the canes frequently kill back enough to reduce seriously the crop of fruit. For this reason, it is more promising for the warmer bench lands where peaches are commonly grown. The plants are vigorous, and form large, branched canes. The variety has not been as productive in the plots at Logan as Newburgh. The quality is excellent, the sugar content higher than most varieties, and the color, form and flavor are well retained in freezing preservation.

NEWBURGH is a comparatively new variety in Utah which merits consideration and testing for commercial purposes, as well as home use. The berries are rounder than Cuthbert and Taylor, very large and borne with an abundance on the canes that causes them to bend to the ground with fruit. The fruit is far easier and faster to pick than the older varieties, both by reason of its large size and its habit of fruiting canes bending out into the row so that pickers do not have to hunt among new prickly canes for the berries. In the variety test at Logan, Newburgh had the highest individual yielding plot, which yielded 16.5 pint cups to fifteen feet of row, as compared to 10.6 for Latham, 10.4 for Taylor and 9.0 for

(Continued on page 11)

FARM AND HOME SCIENCE

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More detailed information on the subjects discussed here can often be found in Station bulletins and circulars or may be had through correspondence.

College series no. 681

By A. L. STARK

FRUIT yields in Utah have decreased steadily since the industry reached its peak of expansion in 1910 to 1920. Many factors have contributed to this decrease. With peaches, one of the most important contributing factors was that of continued clean cultivation. Peach growers thought that it was necessary to have their orchards free from any vegetative growth for maximum production. This continued cultivation resulted in the burning from the soil of all of the natural organic material that was present at the time the orchard was planted. As a result, peach orchards began to decrease in vigor and production. The declining yields pointed out the need for some definite information on soil management and fertilizer treatment for maximum production of peaches in Utah. The Utah Agricultural Experiment Station recognized this need and in 1940 set up experiments designed to determine the most suitable fertilizer and soil management practices for peach orchards under Utah soil and climatic conditions.

It was decided that the experiments should be conducted in Box Elder and Utah Counties, where a large percentage of the peach tree population of the state is now located. An additional site was recently selected in Washington County, where studies will be conducted on soil and fertilizer tests on peaches in that area.

In establishing the experiments, one of the principal considerations was that of adding organic matter to the soil in an effort to eliminate the difficulties that were being experienced under clean cultivation. In view of the fact that the supply of barnyard manure is limited in the most concentrated fruit-producing areas, some form of green cover crop is necessary to supply this organic mat-

EXPERIMENTS SHOW BENEFITS OF FERTILIZERS IN PEACH ORCHARDS

ter. Alfalfa was used as one of the cover crops because of its popularity in other fruit sections and its soil-building properties. Hairy or winter vetch was selected as the other cover crop. This has many advantages as a cover because the seed is planted in the fall after the fruit harvest is completed and the vetch reaches its maximum development by late spring and may be plowed in before fruit thinning time, leaving the orchard relatively clean for irrigation and harvesting. Like alfalfa, it is a legume and has a tendency to increase the nitrogen supply of the soil when turned under. These two covers were compared with clean cultivation which consisted of allowing the natural vegetation or weeds to develop in the orchard until disked in at the same time as the vetch. In this way the weeds furnished organic matter and were a source of plant nutrients the same as any other cover that might be planted.

Five different fertilizer treatments were applied with these three cover crops. One treatment consisted of ammonium sulfate alone, one of treble superphosphate alone, then a combina-

tion of these two. Barnyard manure was a fourth and the fifth consisted of no fertilizer application for comparison.

The trees treated with manure received a spring application at the rate of ten tons per acre every year. The commercial fertilizers were applied at the rate of three pounds per tree, three to four weeks before bloom. Trees receiving both nitrogen and phosphorus were given three pounds of each fertilizer. The treble superphosphate was dug in with a spade while the ammonium sulfate was broadcast.

Results of the Fertilizer Tests

On both the orchards in Utah and Box Elder Counties the results were similar, so to shorten the discussion only the results from the Perry Dalton orchard at Brigham City will be given. At the beginning of the experiment in 1940 the Elberta peach trees in this orchard were eleven years old.

The average yield of twelve trees in the orchard not receiving fertilizer over the four-year period was at the rate of 308 bushels per acre. This is far above the state average, which is less than 100 bushels per acre for all peach orchards. Trees receiving ammonium sulfate alone gave an annual average yield of 478 bushels per acre; while those receiving a combination of ammonium sulfate and treble superphosphate produced 509 bushels per acre as an average for each of the four years. The striking difference between trees not fertilized and those receiving the combination of nitrogen and phosphorus is remarkable. The fertilizer treatment resulted in an increased production of 201 bushels per acre over the trees that were not fertilized. This represents an increase of 66 percent in total yield of peaches as a result of the application of 6 pounds per tree of the commercial fertilizers.

When nitrogen was applied alone an increase of 170 bushels per acre was attained. The effect of barnyard manure was to increase the yield appreciably, but the average of trees receiving manure did not equal that of trees receiving nitrogen plus phosphorus every year.

The effects of fertilizer treatments were not only noticeable on the amounts of fruit, but also on the color and other characteristics of the fruit. Trees not fertilized or fertilized with phosphorus

The Authors

D. G. Sorber, in charge of the fruit section of the Commodity Processing Division of the Western Regional Research Laboratory at Albany, California, has been cooperating with the Utah Station for a number of years in the freezing preservation of fruits. The material in this paper was first presented at the meeting of the Utah State Horticultural Society in January 1944.

The Western Regional Research Laboratory is one of four research laboratories operated by the Bureau of Agricultural and Industrial Chemistry of the U. S. Department of Agriculture. The others are located at Peoria, Illinois; New Orleans, Louisiana; and Philadelphia, Pennsylvania. These laboratories were established to investigate new industrial uses for farm wastes and crop surpluses. At the present time the Western Laboratory is devoting much of its efforts to food problems relating to the war effort such as dehydration and freezing preservation.

Professor F. M. Coe, head of the Department of Horticulture, has cooperated with Mr. Sorber in fruit freezing investigations; he has also had charge of the variety testing at the Station.

Dr. A. L. Stark, research associate professor of horticulture, has just become a full-time member of the Station staff. Previously he has spent part of his time as extension horticulturist. He will have charge of the Horticultural Experimental Farm in Weber County.

Byron Alder, head of the Department of Poultry Husbandry, has written a number of other articles for Farm and Home Science on poultry problems. His suggestions on feed conservation are very pertinent at this time.

(Continued on page 11)

By BYRON ALDER

POINTERS ON CONSERVING POULTRY FEED WHILE CONTINUING TO MAINTAIN HIGH PRODUCTION

EGG production in the United States during the past 3 months has passed all previous records for this period. In January of this year production was 17 percent above January, 1943; February, 16 percent above a year earlier; and in March, 5 percent above last year. This increase was largely the result of extremely mild weather over most of the United States during this period as there was only 5 to 6 percent more hens or pullets of laying age on the farms in the United States than a year earlier.

Egg surpluses were more acute because of labor shortages, a shortage in some areas of egg cases, and a lack of cold storage space to hold the surplus eggs until they could be moved in an orderly manner through the usual channels. A much more rapid decrease in layers in March and April of this year than a year earlier and the nation-wide program of the War Food Administration in buying daily all shell eggs offered in car lots under its support program should develop a more favorable egg market in the near future.

The feed situation has not been serious to date, but the amount available is limited. The supply of most protein supplements appears to be better than last year, but grain supplies are lower. A short crop of feed grain produced in 1944 would make the situation serious. It is urgent, therefore, under present conditions, and is a good general practice at all times, to conserve feed in every possible way.

Producers should not lose sight of the fact that a large volume of eggs and poultry meat, at least equal to the amount produced in 1943, is still necessary to meet the needs of the armed forces, aid to our allies, and to supply civilian demands during the coming year. The poultry industry in Utah could save many tons of feed and at the same time increase the average net income per farm without any serious reduction in the supply of eggs and poultry meat by adopting a feed conservation program as follows:

Keep Feed Troughs in Repair

Check over feeding equipment and repair or replace all broken or worn out feed troughs. An adequate supply of good feed troughs for every flock is essential. Feeding the growing or laying flock a full, complete ration is not wasteful but necessary for rapid growth

or heavy egg production. Filling the mash troughs too full or using small, poorly constructed mash troughs so that part of the feed is billed out of the troughs and wasted is an all too common practice on poultry farms.

If the average annual egg production in a flock of Leghorn hens is about 200 eggs, and the average feed fed per hen is over 90 pounds of grain and mash, feed is being wasted. If the average egg production is 160 eggs and feed fed per bird over 82 to 85 pounds, again feed is being wasted. If broilers at $2\frac{1}{4}$ pounds live weight have been fed more than $3\frac{1}{2}$ pounds of feed per pound of broiler produced or if turkeys at market time, 29 to 30 weeks old, have been fed more than $5\frac{1}{4}$ pounds of total feed per pound of turkey produced, something is wrong; feed is being wasted.

Feed lost in the litter because of poor or inadequate troughs is not the only feed wasted. Non-layers in a laying flock consume about 6 pounds of feed per bird per month. At this season and continuing on through the summer and fall, all laying flocks should be culled regularly, and every hen taken out as soon as she stops laying. Marketing non-layers and poor layers saves feed.

Pasture Saves Other Feeds

Good range supplying an abundance of fresh green feed will save 10 to 15

percent of the grain and mash required to produce well developed pullets or well fleshed and fattened turkeys next fall and winter. Alfalfa or clover makes the best pasture for pullets or turkeys, but any young, tender, succulent, green feed will give good results. Pullets or turkeys raised in close confinement or on dry, barren range supplying little or no green feed should be fed a growing mash containing 15 to 20 percent of a good grade of alfalfa meal after the birds are 8 to 10 weeks old. A daily feeding of fresh lawn clippings or well cured, leafy alfalfa hay will also save grain and mash and produce well finished birds when alfalfa meal is not available or more expensive.

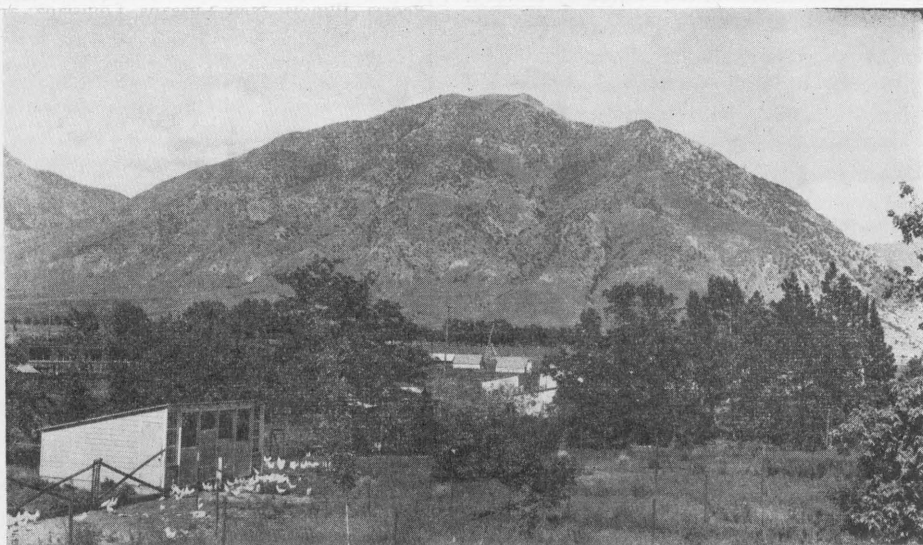
Feed fed and digested by growing birds or laying hens is first used for daily body maintenance which requires about three-fourth of the full ration consumed. Only after maintenance requirements are supplied are nutrients available for growth or egg production.

(Continued on page 7)

Feed troughs for a large flock of turkeys should be moved every three or four days to get the birds onto clean ground and fresh growing green feed



Ideal range conditions for growing pullets providing an abundance of green feed and natural shade





Crested wheatgrass approaching seed maturity on the Benmore pastures. A stand such as this should yield over 200 pounds of seed per acre—Courtesy U. S. Soil Conservation Service

SOME 10 years ago the federal government purchased a large tract of abandoned dry farm land in Tooele County as well as some lands that were still being cultivated. Much of this area had not been productive under cultivation but it did appear to be good range land. It was planned, therefore, that the area should be turned back to range and used for grazing of livestock.

Owing to the fact that much of the area had been broken up and the native range plants were no longer present it was necessary to seed it to grasses. No definite information was available to indicate what grasses were most suitable nor how or when they could be planted for best results. Neither has there been information available to indicate the proper grazing management of introduced grasses when established on range lands. Consequently a portion of the area was set aside for experimental uses where some of these questions could be answered.

The experimental area is located at Benmore in the southeastern part of Tooele County, south of Vernon and immediately north of the Vernon Division of the Wasatch National Forest. It consists of some 3500 acres, 2800 acres of which is divided into pastures of 100 acres each, and all are separately fenced, and have been seeded to crested wheatgrass. The remaining portion of the area is used for grass seeding experi-

ments and for cattle holding pastures.

The area is typical of thousands of acres of abandoned farm land in the state that are now producing little or no forage and that are of low quality. Hence, the experiments conducted should be of value in pointing the way toward the most effective methods of seeding and management of these lands. There is no doubt that these lands can be made to produce appreciable amounts of forage and furnish feed for a large number of livestock during the critical spring and fall months of the year when

NEW PUBLICATION

Bul. 312. Cache: a beardless, smut-resistant winter wheat, by R. W. Woodward and D. C. Tingey. Department of Agronomy and Soils in cooperation with the U. S. Bureau of Plant Industry, Soils and Agricultural Engineering. 10 p.

Cache excels Relief and Utah Kanred in resistance to smuts found in this region. It also shows a higher resistance to lodging and shattering, and the quality of being beardless makes roguing plots for seed increase much simpler in fields where volunteer plants from bearded varieties are present. It is about equal to Relief and Utah Kanred in yielding ability.

A copy of this publication may be obtained free by addressing a card to the Utah Agricultural Experiment Station, giving number and series.

Benmore Area Location

Station Cooperates With Federal

Man

By

the feed is gone from the winter range and the summer ranges are not yet ready for grazing.

The experimental area is managed under the jurisdiction of the Soil Conservation Service with Victor Surface of Tooele in charge. The experimental work is conducted by the Agricultural Experiment Station of the Utah State Agricultural College, the Intermountain Forest and Range Experiment Station of the Forest Service, the Soil Conservation Service Branch of Research, and the Forage Crops Division of the Bureau of Plant Industry. Grass reseeding investigations are conducted jointly by the Forest Service and the Agricultural Experiment Station. The grazing investigations are conducted by the Forest Service with Dr. George Stewart as project leader. The livestock breeding and management experiments are under the supervision of the Agricultural Experiment Station with Dr. I. F. Edwards as project leader. Soil and water conservation studies are under the supervision of Dr. C. W. Lauritzen of the Soil Conservation Service Branch of Research with headquarters at the College.

During the past few years the work on the area has been centered on getting grass established in the experimental pastures. Although some of the pastures were grazed a year ago the grazing and livestock experiments were not initiated until this spring. On April 19 approximately 200 cows, heifers and steers, together with 39 calves, were turned into the area for the grazing experiments. The cattle were furnished by several operators living at Vernon and are typical of those grazed on the private and public ranges of the area. They were weighed and then distributed among the pastures on the basis of ownership, age, sex, grade, and condition to assure uniformity among the groups between pastures.

The purpose of the grazing experiments is to determine how crested wheatgrass pastures should be managed for maximum production of forage and for sustained yield year after year. It is planned to conduct experiments over a period of years to determine how early crested wheatgrass pastures may be grazed in the spring without doing in-

f Cattle Investigations

ving Range and Livestock

jury to the plants, how intensively the grass can be grazed, what the grazing capacity is, and how late in the spring season the grass may be grazed before it goes into the dry summer period. Grazing tests will also be conducted in the fall after the plants have made their new fall growth.

Animal husbandry investigations on the Benmore Area have been designed to determine the influence of (1) the age heifers are bred and (2) improved spring-fall crested wheatgrass range on reproduction in beef cattle. Cows, 2-year-old heifers, and yearling heifers used in the grazing investigations are also being used for the livestock studies. The efficiency of reproduction is to be measured not only in terms of calf-crop percentage but also on the basis of weaning weights and quality of calves produced.

The spring grazing season is regarded as a critical time of year in range beef cattle production. Studies at Benmore will give particular emphasis to determining the value of crested wheatgrass during the spring months for cows with calves at side and to condition cows for the breeding season. The efficiency of reproduction for cows and heifers grazed on crested wheatgrass will be compared with that of a control group grazed under usual conditions in the area.

Allowing heifers to be bred when yearlings is a common practice under

range conditions in this state. Results of experiments previously conducted do not indicate clearly whether or not this is the most desirable practice. Experimental data and observations of cattlemen indicate, however, that heifers calving when 2 years old usually do not attain the size at maturity which is reached by heifers calving when a year older. Young heifers are more likely to have difficulty at calving time, particularly if they are in poor condition. Calves weaned by 2-year-old heifers usually weigh less. Some operators have found that heifers calving when 2-year-olds may fail to conceive in time to produce a calf the next year. Are these disadvantages offset by the extra calves obtained when heifers are bred to calve early? What part does proper wintering and good spring-fall as well as summer range play in developing heifers so that successful reproduction is attained when 2 years old? The investigations at Benmore have been designed to attain information relative to these questions. Of 88 yearling heifers being grazed on crested wheatgrass, part will be bred this summer and the rest will not be bred until the summer of 1945 when 2 years old. The reproduction records of these heifers will be compared with those of heifers in a control group grazed under usual conditions in the area and allowed to be bred when yearlings. The study will extend over a period of at least 5 years.

In most cases Utah range cattlemen have had no opportunity to control the age to breed heifers since young heifers are grazed on the open range along with the breeding herd. The outlook for extensive reseeding and establishment of

breeding pastures in the future promises facilities which will allow range cattlemen to control the breeding in their herds. Therefore, it is particularly important to obtain more information relative to the most desirable age to breed range heifers.

A used pea viner has been purchased by the Station and is being installed at the Davis County Experimental Farm at Farmington. This viner will greatly facilitate the research work being conducted on canning and freezing peas by the departments of Vegetable Crops and Agronomy and Soils. In the past there has been too much variation because of delays in vining and in the use of different viners. It is now hoped that these variations can be eliminated and thereby make possible the measuring of smaller differences between various treatments in the growing and processing of peas.

CONSERVING POULTRY FEED

(Continued from page 5)

An increase in daily feed consumption above that required for maintenance results in increased rate of growth or increased egg production in direct proportion to the amount of feed so available, and to the nutrients it supplies that are necessary for growth or egg production. Birds should be fed all they will consume every day.

Keep the flock under clean, sanitary conditions, and cull out all unthrifty birds or those showing evidence of disease. Avoid overcrowding in the poultry house or on the range.

Keep fresh water always available to the birds. A limited supply of fresh clean water reduces egg production, slows up rate of growth, and wastes feed.

Experimental cattle grazing on the wheatgrass pastures at Benmore, spring 1944



FROZEN FRUIT INDUSTRY

(Continued from page 1)

Before the war and the freeze order prohibiting the manufacture of mechanical refrigerators and freezer storage cabinets, several manufacturers of refrigerators were including a compartment for frozen foods in their standard models of home refrigerators. Other companies were building freezer storage cabinets for home use. Another development was the rapid growth of the cold-storage locker industry. These developments represent a general awakening to the desirability of frozen foods in the diet. Although the manufacturers of these domestic conveniences have been temporarily halted for the duration of the emergency, this appreciation of the quality of frozen foods has not diminished.

Members of the National Association of Refrigerated Warehouses are looking forward with greatly increased interest in refrigerator foods in the post-war period and were instrumental in the recent establishment of the new Refrigeration Research Foundation, the purpose of which is to advance the art of refrigerating commodities. Mr. H. C. Diehl, formerly chief of the Commodity Processing Division of the Western Regional Research Laboratory, became director of this newly formed foundation on January 1 of this year.

So much for the trends in the United States as a whole. Now let us turn our attention more specifically to the State of Utah.

Present Situation in Utah

Utah has established a fresh fruit market, a small canning industry, and in 1942 three companies in this state froze slightly more than 1,600,000 pounds (800 tons) of fruit. During the season just past 7 companies froze 9,546,000 pounds (4,700 tons) of apples, apricots, cherries, peaches, gooseberries, and red raspberries. If the economic side of the question of a permanent freezing industry appeals to the fruit growers of this state, it would appear from a report on the fruit acreage in Utah by the State Agricultural Extension Service that there is considerable acreage available for expansion of fruit growing to supply such an industry. The report also indicates that it is not possible to do this from the present planted acreage without reducing considerably the amount of fresh fruit that ordinarily is supplied from this area.

The establishment of a sizable frozen

fruit industry would provide several advantages for the fruit grower. **It would provide a constant dependable market for the growers' fruit.** It would provide a means for utilizing sound fruit that is not marketable either as fresh or even canned fruit because of blemishes such as hail marks. Fruits that are blemished in this way can be utilized either as sliced, crushed, or pureed frozen fruit. The most rapid increase in size and weight of several of the tree fruits takes place just prior to full maturity, between the stage ordinarily picked for fresh market and the prime ripe stage most desirable for freezing; thus the grower may obtain a greater crop yield. Pureeing as a prefreezing preparation method has thus far accounted for a relatively small proportion, perhaps not more than 5 percent at most of the total pack; yet it is steadily gaining in favor and new uses are continually being found for pureed fruits. Pureeing has the distinct advantage that it utilizes a greater proportion of the crop than other methods do, with the exception perhaps of juice manufacture, since all fully ripe, full-flavored fruit free from mold or decay, regardless of its shape, size, or blemished condition, can be pureed. Another advantage frozen fruits have is that all waste is eliminated during preparation and they are packaged in compact form, more compact than any except dehydrated products or concentrates.

While the establishment of a frozen fruit industry appears to have several advantages for the grower, it would require of them a certain amount of responsibility on their part. The construction and maintenance of preparation and freezing plants require considerable investment. In order to pay out and insure the highest possible price to the grower and the lowest price to the consumer, the packer must be assured of a steady source of supply at prices which are competitive with those of other major fruit growing areas.

Utah has only a slight advantage over the larger fruit-growing sections of the Pacific Coast states in shipment to the Eastern market. While the freight rates from Utah and the Pacific Coast states to Chicago, for example, are the same, Utah has a slight advantage in cost of the refrigeration—that is, in ice and salt charges which amount to \$21 on a 47,000-pound minimum-capacity car.

Utah growers should carefully analyze all the available data on the economic aspects of the industry, to deter-

mine whether they can compete with other fruit-growing areas and with other crops in the Utah area before they encourage the expansion of the frozen pack industry or increase their plantings to support an industry.

Since it is impossible to look into the future, the best that can be done is to examine the data accumulated over a period of years in the past and assume that the future will follow somewhat the same trends. For this purpose some data that apply to fruits most likely to be available to a freezing industry in this state have been assembled. These are tree fruits including apples, apricots, cherries (sour and sweet), peaches, pears, plums and prunes, and small fruit such as blackberries and dewberries, currants, gooseberries, black raspberries, red raspberries, and strawberries. With any fruit or vegetable to be preserved by freezing, varietal characteristics are of primary importance and for this reason much of the early research work done in the U. S. Frozen Pack Laboratory was the appraisal of different varieties in relation to their quality for freezing preservation. The same policy was followed in the first cooperative projects on freezing preservation set up between the Utah Agricultural Experiment Station and the Laboratory of Fruit and Vegetable Chemistry of the U. S. Department of Agriculture and later with the Western Regional Research Laboratory when the work was discontinued in the former laboratory. These varietal selection projects are necessarily of rather long duration and since a number of processing problems have come up as the result of the emergency, which give promise of quick solution with a resulting contribution to the war effort in food preservation, the varietal selection program has been temporarily set aside with the exception of two dealing with Utah-grown raspberries and strawberries.

Since many varieties have proved their worth in the early research work and subsequent commercial handling, only those varieties of commercial importance will be considered in this discussion.

Apples

Frozen apples are used primarily by pie bakers although a beginning was made during the past year in freezing apple puree. The principal commercial varieties used for freezing are Newton Pippin, Rome Beauty, and Winesap. While the Jonathan, Utah's chief variety, has not found its way into many

commercial frozen packs, it has been frozen last year in Utah.

Apples are Utah's second largest fruit crop, on the basis of the 1939 U. S. Census report of 23 million pounds (11,500 tons). On the basis of the 1941 and 1942 crops, the 1939 crop seems to be a little larger than the average. There were 961,200 pounds frozen in this state last year.

The average price paid to farmers for apples in the United States for the ten years from 1931 to 1940 was 76 cents per bushel, or \$31.60 a ton. During the ten years from 1921 to 1930, the average price was \$1.20 per bushel or \$50 per ton. The highest price paid during this entire period was \$1.64 a bushel or \$68 a ton in 1921, while the lowest price was 60 cents a bushel or \$25 a ton in 1930.

Apricots

Frozen apricots are used for the manufacture of preserves, jams, baby food, and for pies and other bakery products.

The Chinese or Jones, properly named Large Early Montgamet, the chief apricot variety in Utah, has proved its worth in commercial frozen pack. There were 8,600,000 pounds (4,300 tons) produced in the state in 1939. This crop fluctuates considerably from year to year, for only 2,600,000 pounds (1,300 tons) were reported for 1941 and nearly two and a half times as much, or 6,200,000 pounds (3,100 tons), for 1942. Of this later crop, 1,163,620 pounds (581 tons) were frozen, while in 1943 the amount frozen jumped to 5,686,000 pounds (2,843 tons).

The entire commercial crop of apricots in the United States is grown in the western states, principally California, Oregon, Washington, and Utah. Since 95 percent of the crop is produced in California, the prices paid in that state will probably govern the price paid the growers for apricots for freezing. The farmers in California received an average of \$37 a ton from 1931 to 1940, inclusive, while the average for the previous ten years was \$56 a ton. The highest price paid during this 20-year period was \$76.50 in 1922 and the lowest price was \$18.90 ten years later in 1932.

Cherries, Sour

Frozen red sour pitted cherries make excellent pie, which is by far the greatest use made of them. The Montmorency variety, which is generally grown in Utah, is the variety most commonly

frozen. This crop, too, fluctuates considerably from year to year. Over the four-year period from 1939 to 1942, Utah is credited with an average yield of 3,260,000 pounds (1,630 tons) with the lowest, 2,140,000 pounds (2,450 tons), the following year. Utah packers froze 450,000 pounds (1,070 tons), in 1939 and the highest, 4,900,000 pounds (225 tons) of cherries in 1942 and 1,733,700 pounds (867 tons) in 1943.

The average price paid the farmers in the 12 cherry-producing states in 1939 was \$43.37 per ton, and \$59.34 in 1940. The prices paid in Utah for the same years were \$50 a ton in 1939 and \$44 in 1940.

Cherries, Sweet

A relatively small pack of sweet cherries has been frozen each year for several years past. The varieties generally used for this purpose are the Lambert and Napoleon or Royal Anne, both of which make up a large proportion of Utah's acreage. Other varieties such as the Black Tartarian have been found satisfactory.

This state's production for the four years from 1939 to 1942 inclusive averaged 5,190,000 pounds (2,595 tons) with the highest yield 7,800,000 pounds (3,900 tons) in 1941 and the lowest, 2,760,000 pounds (1,380 tons) in 1939. A small pack of sweet cherries, 74,070 pounds (37 tons) was frozen in Utah, apparently for the first time during the season just past.

The average price paid the growers of sweet cherries in the 12 cherry-producing states in 1939 was \$80.69 per ton, and \$104.98 in 1940. The prices paid the growers in Utah for the same years were \$70 a ton in 1939 and \$80 in 1940.

Peaches

Frozen sliced peaches are packed in consumer packages for direct consumption and also in 30-pound packages and barrels for the manufacture of bakery products, preserves, jam, baby food, and for use as a flavor base for ice cream. Peaches are, according to the 1939 U. S. Census crop report, Utah's largest fruit crop. The Elberta variety is dominant and most commonly frozen. The J. H. Hale, the variety second in importance, is perhaps also second so far as freezing preservation is concerned. In fact the Hale has a better texture for freezing than does the Elberta and when it is full-flavored is considered by many to be second only to the Rio Oso Gem as a freezing variety.

Utah's average peach production for the three years 1939, 1941 and 1942 was 27 million pounds (13,500 tons) with the highest yield, 36 million pounds (18,000 tons) in 1941 and the lowest, 16 million pounds, (8,000 tons), in 1942. There were 1,009,705 pounds (5,005 tons) of peaches frozen in Utah in 1943.

The average price paid for peaches in the United States in the ten years from 1931 to 1940 was 93 cents per bushel or \$38.40 per ton. During the previous ten-year period, from 1921 to 1930, the average price obtained by the grower was \$1.22 per bushel or \$50.80 per ton. The highest price recorded in these 20 years was \$1.55 a bushel or \$64.40 a ton in 1921, and the lowest 60 cents a bushel or \$25 a ton in 1931.

Pears

Small packs of pears, which should perhaps be classed as the first commercial experiments, were frozen last season in California and Utah. The Utah pack amounted to 12,000 pounds (6 tons). Since the future of this fruit as a frozen product is still very uncertain, it is not worth while to do more than mention it. Pears can be successfully frozen either whole or as halves or quarters for making pear jam or as halves or quarters for bakery products or as puree for ice cream or sherbet flavor base. If frozen pears do attain any commercial importance the Bartlett and Buerre Hardy are the varieties most likely to be used.

Plums and Prunes

Santa Rosa plum puree is coming to be a popular sherbet flavor base. The Italian prune, the variety most extensively grown in this state, is the one most commonly frozen for subsequent manufacture into preserves and jam. The frozen prune pack in California and the Pacific Northwest increased from approximately 3 million pounds in 1942 to 24,585,400 pounds (12,292 tons) in 1943. This exceedingly large increase, which came as a demand for fruit to take the place of berries, was not reflected in the Utah pack. There were 4,920 pounds of plums and 930 pounds of prunes frozen in Utah last year. The production of plums and prunes of all varieties reported for Utah in 1939 is small, that is 157,000 pounds (78.5 tons).

Small Fruits

Some attention should be given to the small fruits, since they have played the major role in the frozen fruit in-

dustry in the past, at least until the last year or two. These, of all fruits, are the ones that produce a full crop in the shortest time and for this reason are the ones most subject to change from year to year.

The rise and decline of the frozen fruit industry in Utah prior to 1935 had to do with strawberries and raspberries. The pack of frozen barreled berries grown on the Provo Bench rose from 600,000 pounds (300 tons) in 1925 to 4,800,000 pounds (2,400 tons) in 1932, the year of the lowest prices experienced in the history of frozen pack. The production dropped to 500,000 pounds (250 tons) two years later and none is reported for 1935.

Blackberries and Dewberries

All the commercial varieties of this group, which include Boysen, Young, and Logan varieties of dewberries as well as the Lawton, Urlson, Evergreen and wild blackberries, find their way into the freezing plants of the Pacific Coast states.

Utah's total acreage of this group was 150 in 1940. Youngberries are not productive in Utah, and all dewberries require winter protection. None of the berries in this group are in the list of fruits reported to have been frozen; however, it might be worth while to note the prices paid the growers by freezers in the Northwest for some of these during the period from 1927 to 1942, just in case any of the growers are considering expanding their acreage.

Price paid per pound (cents)

Variety	Average price	Range	Median
Blackberries	3.6	1½ to 8½	3 & 4
Loganberries	4.2	1½ to 8	5
Youngberries	4.4	2½ to 7½	3 & 4

Currants

There were 13 acres of currants reported for Utah in 1940. While currants have not been frozen thus far in Utah, there is usually a small pack in the Northwest. The prices paid the growers for currants to be frozen for the period 1934 to 1937 and in 1939 averaged 3.9 cents per pound. The range was from 2½ to 7½ cents and that most frequently paid was 3 and 4 cents.

Gooseberries

Frozen gooseberries make excellent pies. There were 13 acres credited to this fruit in the Utah acreage report for 1940. Last year 5,950 pounds (3 tons) from these acres went to the freezer. The prices paid the farmer in the Northwest for gooseberries to

freeze in the years from 1934 to 1942 inclusive averaged 5 cents a pound. The price ranged from 2 to 7 cents and that paid most frequently was 3 cents.

Raspberries

The last two fruits to be considered, namely raspberries and strawberries, are the ones with which the frozen pack industry was started and the ones that have accounted for a larger percentage of the pack than all other fruits put together, at least until the last year or so. They are also the most unpredictable, so far as the immediate future is concerned, because of conditions resulting from the war emergency.

Frozen raspberries are packed in consumer packages but by far the largest proportion of the pack has gone to the preserve and jam manufacturer and to the ice cream makers for sherbets. The Cuthbert is the principal variety frozen, although there are several new varieties, such as the Tahoma and Washington, that are rapidly gaining favor in Oregon and Washington. The 561 acres of red raspberries in Utah in 1940 were mostly the Latham variety. Although not considered as good in quality as the Cuthbert, it makes a satisfactory frozen product. The new Taylor variety now being planted in Utah is a high-quality variety for freezing.

The prices received by the farmers of the Northwest over the years from 1927 to 1942 inclusive averaged 7 cents a pound. The price most frequently paid in the range of 3 to 12 cents was 5½ cents per pound.

Strawberries

Strawberries, from 1910 up to 1943, have been the most important of all the frozen fruits. They are used chiefly for preserves, bakery goods, and ice cream. Strawberries were not reported frozen in Utah in 1943.

The Marshall, because of its high-quality berries, has been the variety most extensively planted in Washington, Oregon, north central California, and Utah. The Klondyke leads in southern California and some of the southern states.

The prices paid by packers of frozen fruit in the Northwest from 1927 to 1942 inclusive averaged 5.4 cents in a range from 2 to 8 cents a pound. The price most frequently paid was 5 cents a pound.

The war with its resulting labor conditions has brought about a considerable decrease in strawberry acreage resulting in extremely high prices.

	Average 1933-42	1943	Estimate for picking in 1944
	acres	acres	acres
Oregon	11,200	16,780	7,000
Washington	7,030	5,000	3,500
California	5,220	1,880	1,750
Utah	1,210	1,100	1,000
Total (Western region)	24,660	16,780	13,250

It is impossible to foresee what is going to happen in the way of future plantings of this fruit, which has the highest vitamin C content of any of the common commercial fruits, including oranges. It is reasonable to believe that there will be a ready market at very favorable prices for some years to come unless the present extremely high prices stimulate uncontrolled overplanting.

Conclusion

In conclusion it can be said that there is every indication of a rapid expansion of the frozen fruit industry in the United States in the post-war era.

As to the question of the possibility of a relatively large permanent frozen fruit industry being established in the state of Utah, only the growers and packers and the economic and labor conditions with which they are faced can provide the answer. Before increased plantings are made or much capital is invested in new plants, more data than have been given here should be assembled and carefully studied. Such data, it might be suggested, should be obtained from a survey of acreage and water supply available to produce profitable crops year after year and the expected yield and return per acre compared with competitive crops marketed in other ways. Two important considerations in arriving at the potential return are available: labor and labor costs. The labor requirements estimated for each month of the year on the basis of man hours for each of the above-mentioned crops, as well as many others, already have been made available in the Utah Agricultural Experiment Station report on "Labor requirements to meet 1943 agricultural production goals in Utah," Mimeograph series 291.

If the final answer should be in favor of establishing an extensive frozen fruit industry in Utah, the Western Regional Research Laboratory in cooperation with the Utah Agricultural Experiment Station stands ready to assist in any way possible in its technological development.

RASPBERRY VARIETIES

(Continued from page 3)

Cuthbert. In the plot averages, Newburgh was exceeded in yield by only one variety, a similar but unnamed New York seedling, 14443. Average yields and yield of the highest yielding plots for the varieties in the test are summarized in table 1.

Table 1. Yields (in pints) of 14 raspberry varieties in 3 year old plots† at Logan, Utah, 1943

Variety	Mean yield of plots	Yield of highest-yielding plot
14443*	10.67	14.8
Newburgh	9.70	16.5
Latham	8.73	10.6
8111*	7.45	15.5
Washington	6.95	9.6
June Red	6.66	9.6
Taylor	6.26	9.3
6520*	5.90	6.7
Sodus (purple)	5.05	5.35
Indian Summer (everbearing)	5.07	10.7
Cuthbert	4.94	9.0
8126*	4.64	8.8
Tahoma	4.52	8.8
Marcy	2.65	3.9
Avg. yield	6.35	10.09

*Numbers refer to New York Station seedlings under test.

†There were from 3 to 5 plots of each variety.

Too much importance should not be attached to differences in yields as given in table 1, since only one year's results in the first year of bearing are available, and the yields were affected considerably by variation in stand of plants and in irrigation the preceding year. However, the data largely agree with previous observations indicating that Newburgh, 14443, and Taylor are more productive than Cuthbert.

WASHINGTON is a new variety introduced by Dr. Schwartze of the Western Washington Experiment Station to replace Cuthbert, which has suffered frequent winter-killing in the Northwest. Tahoma is a companion variety from the same source. Washington appears the more promising of the two, having high quality fruits and being more hardy than average. The canes are vigorous and fill in the rows rapidly. The fruit is smaller than Newburgh, Taylor, and Latham in the Utah Station test plots at Farmington and Logan, and more difficult to pick. The fruit has shown up well in freezing tests, rating very good in flavor, and higher than average in sugar content. Tahoma has appeared the less promising of the two here.

New York (Geneva) Station seed-

lings nos. 14443 and 8126 have appeared most promising of the unnamed seedlings under test here. The 14443 is similar to Newburgh though somewhat hardier, but showed a higher percentage of sunburned fruit last season than the older parent variety. No. 8126 is an attractive early dark red tart variety of marked hardness which should be especially suitable for ice cream and jam making because of its tart flavor. Fruit of this variety has not been as uniformly large as Newburgh or Taylor, nor as firm as the latter sort. It appears to merit further testing for freezing and jam purposes, and for colder locations. This variety is not available for public distribution until finally judged worthy of naming and introduction by the originators.

INDIAN SUMMER is a promising new everbearer with larger fruits than the older Ranere (St. Regis) commonly grown. The fruits are of good color and quality, but are softer than the standard varieties. Like all so-called everbearing raspberries, Indian Summer bears two crops, the summer crop in late June and July, and a fall crop in September and October, the latter on the new canes. The summer crop ripens with the earliest summer variety, June Red, and is valuable for early berries, but rather soft for market. It is primarily a raspberry for home use, although the summer crop can be used to advantage for frozen puree for ice cream, where firmness is not important. The variety has the fault of producing few canes and suckers, which makes its propagation slow.

SODUS is an interesting new purple-cane raspberry variety, one of a class of hybrids between the reds and the blackcaps. Showing great hybrid vigor, the fast growing canes lack hardness and winter-kill worse than all the reds under test except Marcy. When not injured, the canes are extremely fruitful, the berries large, dull purplish red in color, highly flavored, and make richly colored and flavored jam and puree. Unfortunately, the seeds are objectionably large.

MARCY has been tested in Utah County by private experimenters and by the Station at Farmington and Logan. While showing up well as a frozen berry, its large, dark red, highly flavored berries receiving the commendation of the judges, unfortunately the canes are quite tender to winter-killing, and the yields are often seriously reduced as indicated in table 1.

JUNE RED is an older variety grown in a limited way for early market and home use. The canes are smooth, without prickles, but are produced in limited numbers. The fruit is large on the lower fruiting shoots, but often small and crumbly toward the ends of the canes. The color is light red, and the flavor mild and sweet.

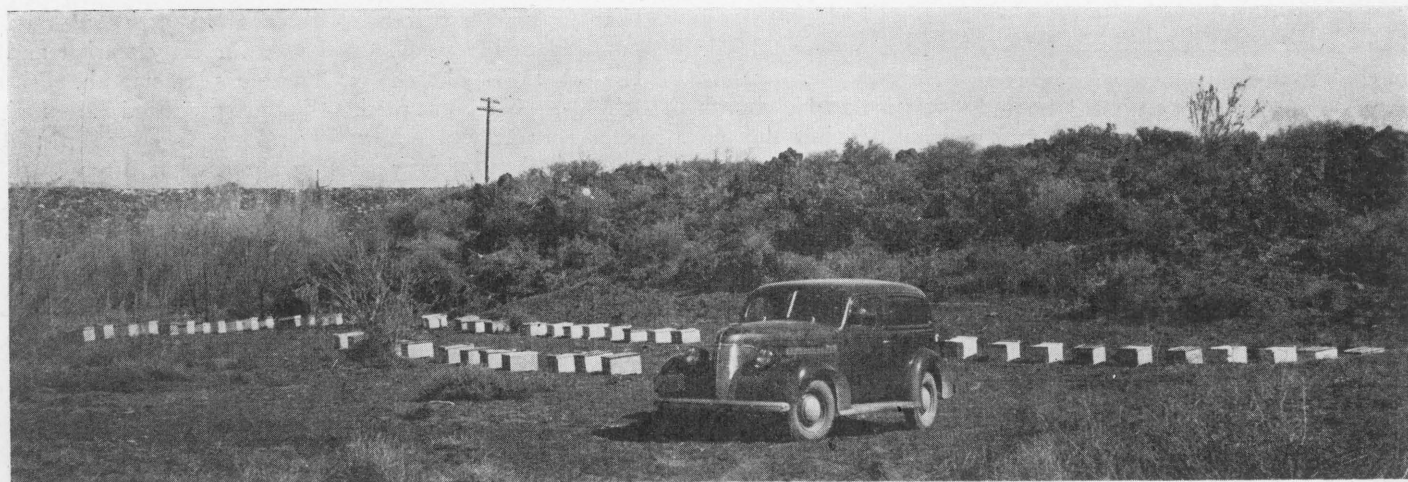
PEACH ORCHARD FERTILIZERS

(Continued from page 4)

alone were inclined to ripen their fruit much earlier and more uniformly than trees receiving nitrogen, manure, or a combination of nitrogen and phosphorus. The effect of the fertilizer treatment on fruit color was especially noticeable. Trees receiving phosphorus alone produced fruit of much higher color, which was invariably chosen by purchasers who came into the orchard and selected their fruit. The fruit from these trees appeared to have a higher sugar content, which is usually associated with higher color. Fruit from the trees fertilized with nitrogen alone was usually ten days to two weeks later than that harvested from the trees receiving superphosphate alone.

The influence of fertilizers on the color of the foliage and the general vigor of the tree was noticeable. Vigor is usually correlated with yields and trees receiving nitrogen, nitrogen plus phosphorus, and barnyard manure showed greatest vigor. Trees receiving phosphorus alone and those receiving no fertilizer treatment showed least vigor as indicated by annual terminal shoot growth and annual increase in cross-section of trunk area.

In deciding fertilizer practices, growers should not be guided solely by the better color and eating quality of the fruit from the trees receiving no fertilizer or phosphorus alone. Even though the fruit excelled in these characteristics, yields were low and higher profits might be expected from trees fertilized with nitrogen plus phosphorus in combination where the fruit was of good commercial color and production much higher than on trees not fertilized or receiving phosphorus alone. On the basis of findings thus far, a combination of ammonium sulfate and treble superphosphate would produce the most fruit of good color, size and quality. Where barnyard manure is available, this should be used as far as possible, but where it is not a combination of commercial fertilizers and green manure or cover crops is most desirable.



One of the many colonies of bees throughout the state that are being inspected in the study to find causes of the heavy losses

Suggestions for Reducing Bee Losses in Utah

By GEORGE F. KNOWLTON

HUNDREDS of colonies of Utah honeybees died out during the season of 1943 from causes other than diseases. In a large percentage of the cases, such losses were associated with dangerous amounts of arsenic in the pollen, in the bees, or both. While some beekeepers lost their field forces of bees at the time nearby orchards were sprayed, and two bee yards reportedly died out following alfalfa weevil dusting application at a time when an abundance of grass was producing pollen attractive to the bees, much of the death loss occurred during late summer and fall, at a time when little orchard or garden insect control activity was occurring. The most extensive losses occurred in Salt Lake and Davis Counties from August until the first cold spell of fall destroyed the surviving remnants of most arsenic weakened colonies. These losses occurred later in the season than the heavy adult bee losses of 1939, which were during mid to late June; fewer occurred during July.

How Losses Can Be Prevented

Horticulturists, seed producers, and farmers can help prevent adult bee losses traceable to orchard and farm practices if they will: (1) Refrain from spraying or dusting orchards or crop plants during the period of blossom. (2) Clip attractive undercover plants before agricultural chemicals are applied to orchards. (3) Notify beekeepers before extensive spray or dust applications are to be made, so that beekeepers may, if they desire, remove their bees to a safe location before

agricultural poisons are applied. (4) Keep tomato patches free from weeds and apply necessary tomato fruitworm dusts at a time when the air is reasonably quiet. (5) Do not permit dusts or sprays to drift on to fencerow or nearby blossoming sweet clover, alfalfa, or other blossoming or pollinating plants attractive to bees. (6) Apply the late-season spray or dust treatment for asparagus beetle control after the asparagus plants have completed pollination and blossoms have dropped. (7) When alfalfa weevil dusting is necessary, treat at a time when fields are not full of pollinating grasses, attractive weeds or blossoming alfalfa. (8) Dust squash and melons for pest control when blossoms are closed before 6 a.m. or after 4 p.m. (9) Flake out grasshopper and cutworm bait thinly, as is generally recommended; do not store or apply this material carelessly. (10) Apply and store agricultural sprays and dust materials carefully according to approved methods.

What Beekeepers Can Do

Beekeepers can help prevent adult

bee losses by: (1) Not placing package bees in hives containing dangerous amounts of arsenic in the hive pollen, as has been done by some Utah beekeepers during the spring of 1944. (2) Keep informed of the agricultural spray and dust programs of the area where bees are located. Move bees to a distant, safer location if spray or dust programs threaten the safety of the bees. (3) Do not locate bee yards near extensive areas of blossoming loco weed or near dangerous amounts of other poisonous plants. (4) Locate bees near an adequate water supply; this will help to discourage bees from obtaining moisture from nearby drops of spray on fruit, or on other treated crop or undercover plants.

Causes of adult bee losses will again be investigated during the current season. During 1943, 115 samples of dead bees, 63 samples of pollen, and 65 of plants, algae, pond water, etc. were analyzed for arsenic by the cooperating specialists of the U. S. Bureau of Entomology and Plant Quarantine, Rocky Mountain Bee Culture Field Laboratory at Laramie, Wyoming. This federal cooperation will be continued during 1944.

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